

Wohlfahrtiimonas chitiniclastica Infection without Myiasis in South Korea: An Extremely Rare Case Report

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Abstract

Wohlfahrtiimonas chitiniclastica are aerobic, non-motile, gram-negative rods, first described by Toth et al. in 2008. A small number of cases of *W. chitiniclastica* infections have been reported worldwide. These bacteria are transmitted through fly larvae in open wounds of skin and/or mucosal surfaces on the host. *W. chitiniclastica* is pathogenic to humans and can cause severe diseases like septicemia and osteomyelitis. Herein, we report the identification of *W. chitiniclastica* in tissue culture from a severely ill, infected patient without myiasis. Diagnoses of *W. chitiniclastica* without myiasis are often missed; therefore, careful attention is needed. It is reported that *W. chitiniclastica* infection responds well to antibiotics and general treatment of open wounds in diabetic feet. Hence, early intravenous antibiotic treatment and adequate surgical management are required for efficient management and also to prevent progression to severe disease.

Keywords: *Wohlfahrtiimonas chitiniclastica*; Myiasis; Infection

Introduction

Wohlfahrtiimonas chitiniclastica was first described by Toth et al. in 2008 [1]. This bacterium was isolated from the larvae of the parasitic fly, *Wohlfahrtia magnifica*. It is also transmitted by other fly species such as *Chrysomya megacephala*, *Lucilia sericata*, and *Musca domestica* (also known as the housefly), with larvae being deposited in the open wound of the host [2]. These flies are one of the most important causes of myiasis in mammals [3]. *W. chitiniclastica* is an aerobic, non-motile, gram-negative rod that grows best in the temperature range between 28°C and 37°C [1]. It shows strong chitinase activity and is thought to play a role in the metamorphosis of the fly, suggesting a symbiotic relationship between the host and bacterium [1,3]. In a few reported cases, *W. chitiniclastica* is suggested to be pathogenic in humans and can cause severe diseases like septicemia and osteomyelitis, as in the case we report here. Because the transmission of the bacteria is conducted by fly larvae through open wounds or mucosal surfaces of the host, infection with *W. chitiniclastica* is usually accompanied by myiasis [1-8]. Herein, we present an extremely rare case of *W. chitiniclastica* infection without myiasis in a male patient. The patient gave his written consent to the use of his photos.

Case

A 76-year-old man presented to our outpatient clinic with swelling, pain, and a foul

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odor in his right foot that had worsened for three weeks. There was no sign or history of trauma or bug bite on the right foot. The patient did not know when or why he had developed the wound. His medical history included hypertension, diabetes mellitus, and a smoking history of 50 pack-years. He already had his right 3rd, 4th, and 5th toes amputated because of diabetic gangrene. Physical examination revealed a Wagner grade 4 draining ulcer with tenderness and pus-like discharge through the ulcer on the 1st metatarsal head area of his right foot (Fig. 1). Induration extended to 2/3 of his dorsum and plantar of the foot. He was admitted through our outpatient clinic under the assumption that intravenous (IV) antibiotic use was necessary. Initial laboratory data was consistent with an elevated white blood cell count of $17.79 \times 10^3/\mu\text{L}$ (normal range: $4.5\text{--}11.0 \times 10^3/\mu\text{L}$) and C-reactive protein of 83.84 mg/L (normal range: ≤ 10.0 mg/L). We started an empirical intravenous antibiotic regimen of 500 mg flomoxef every 12 hours, along with wound culture and diabetic control by insulin injection. Simple radiological findings at admission showed an osteomyelitis pattern with cortical irregularity on the right 1st metatarsal head and proximal phalanx (Fig. 2). Despite wound dressing and antibiotics, the wound worsened. On the 6th day of admission, the patient had chills and a fever up to 40°C . Blood culture was performed directly, and we performed emergency incision, drainage, and ostectomy because of risk of sepsis. Fluctuations were observed in the plantar and dorsum of the entire right foot. In the operating room, we made a linear incision from the dorsum to the plantar of the foot, and a large amount of thick pus with foul odor was drained. We per-



Fig. 1. Photographic findings at admission. (A, B) A chronic draining ulcer was found with induration, fluctuation and severe tenderness. Pus-like discharge and foul odor was observed.

formed massive saline irrigation and radical debridement of necrotic soft tissues. As the patient's 1st metatarsal bone and proximal phalanx was fragile and crumbled, showing signs of osteomyelitis, we removed parts of it with a rongeur until healthy bone was exposed. We then performed culture with bone fragments and soft tissue, and the incision was left open with a silastic drain inserted through the dorsum to the plantar.

Tissue culture samples were inoculated on chocolate, MacConkey and blood agar and incubated at 37°C under aerobic conditions. Gram staining revealed many Gram-positive cocci and rods and Gram-negative rods. Three different bacteria were isolated from cultures: *W. chitiniclastica*, methicillin-susceptible *Staphylococcus aureus* (MSSA), and *Enterococcus faecalis*. *W. chitiniclastica* was susceptible to all antibiotics registered on VITEK 2 system (Table 1). VITEK 2 system (bioMérieux, Nürtingen, Germany) was used to identify the pathogen and antibiotic susceptibility; a fluorogenic methodology for organism identification and a turbidimetric method for antibiotics susceptibility [3,9]. All blood cultures from admission to discharge were negative, suggesting that there was no bloodstream infection. After the sensitivity result came out, the patient received IV ampicillin/sulbactam (1.5 g) every 6 hours, with wound irrigation daily after consultation with the infectious disease department. The patient showed considerable improvement and remained afebrile throughout the hos-



Fig. 2. X-ray findings at admission (A) and 4 weeks after admission (B). Signs of osteomyelitis (cortical irregularity, red arrow, A) visible at admission; after ostectomy with debridement, part of the right 1st metatarsal head and proximal phalanx were removed (red arrow, B), leaving the other bones healthy.

Table 1. Antimicrobial susceptibility of *Wohlfahrtiimonas chitiniclastica*

Antimicrobial agent	MIC ($\mu\text{g/mL}$)	Susceptible
Piperacillin	≤ 8	Yes
Ceftazidime	≤ 1	Yes
Cefepime	≤ 1	Yes
Imipenem	≤ 1	Yes
Ciprofloxacin	≤ 0.5	Yes
Levofloxacin	≤ 1	Yes
Trimethoprim/sulfamethoxazole	$\leq 2/\leq 38$	Yes
Gentamicin	≤ 2	Yes

MIC, minimal inhibitory concentration.

pital stay. After 4 weeks of treatment, the soft tissue infection improved (Fig. 3), the laboratory findings were all within the normal range and follow-up wound culture showed negative results. A mesh split-thickness skin graft was then performed on the healthy granulation tissue, and the patient recovered well and was later discharged. At follow-up, the wound had healed without any complications, and with rehabilitation program, functions such as walking were significantly restored as before. The patient was discharged after 6 weeks of wound management and IV ampicillin/sulbactam administration.

Discussion

W. chitiniclastica is a short, aerobic, gram-negative rod of *Gammaproteobacteria* class with a strong chitinase activity. The known carrier *W. magnifica* carries *W. chitiniclastica* in its normal intestinal flora [9]. This fly has been reported to cause myiasis worldwide and its distribution is gradually expanding [10].

We present the first rare case of *W. chitiniclastica* infection without myiasis in South Korea. Until now, no case has been reported on infection with *W. chitiniclastica* in humans in Korea. In addition, most cases worldwide show myiasis with infection [3] because the transmission of this bacterium occurs through the larvae of the parasitic fly, *W. magnifica* [1]. This species is found in warm regions such as Hawaii, India, Morocco, and Egypt, and places with poor personal hygiene. Furthermore, peripheral vascular disease and chronic open wounds are known risk factors [9]. The majority of infections are polymicrobial [2,3], as in our case, in which MSSA and *E. faecalis* were also identified. There are three major methods to identify this pathogen: matrix-assisted laser desorption/ion-



Fig. 3. Photographic findings 4 weeks after admission. (A, B) After multiple debridements and wound irrigation, signs of infection and patient's symptoms were improved significantly. As the wound bed was clean and healthy, the authors decided to cover the wound with skin graft.

ization time-of-flight mass spectrometry (MALDI-TOF MS; Bruker Daltonics, Bremen, Germany), 16S rRNA gene sequencing, and VITEK 2, the biochemical test used in our study [3]. *W. chitiniclastica* has been reported to be susceptible to the majority of available antibiotics, with beta-lactams being the most common [1-11]. In our case, the clinical course of the patient improved after changing antibiotics from flomoxef to ampicillin/sulbactam with multiple incisions and drainage, debridements and wound irrigations.

In our patient, it was unclear how the pathogen had been transmitted. The patient was a heavy smoker, his diabetes was not under control, and his foot hygiene was poor. He worked as a vegetable retailer, which placed him at risk of exposure to insects. In contrast to other *W. chitiniclastica* infection cases, our patient did not have any evidence of myiasis, and neither were maggots identified by physical examination or gross examination. However, he did have chronic wounds with very poor wound care and hygiene. Similar to other cases, our patient had diabetes and was a smoker. Like other foot ulcers, following the regimen for treating open wounds in diabetic foot, surgical debridement and empirical IV antibiotics were applied initially. However, if this process does not heal the wound, we must consider other causes, such as diabetic foot, blood circulation problems, and infections caused by other causes. In this case, a very rare case of *W. chitiniclastica* infection was reported.

W. chitiniclastica is an emerging pathogen that can infect

humans who come into contact with flies and maggots. It often causes chronic wound infections in patients with poor hygiene and peripheral vessel insufficiency [2]. Therefore, careful attention should be given to this pathogen that can induce severe disease with or without myiasis, because even very rare bacteria can cause infection, and without proper treatment, can eventually result in a septic condition. As observed in this case, successful treatment is possible even for unknown bacteria like *W. chitiniclastica* with proper use of antibiotics and the treatment regimen for open wounds in diabetic foot.

Conflict of interest

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